

THE STROPHOMENIDAE FROM THE FOSSILIFEROUS BEDS OF
BOWNING, NEW SOUTH WALES.

Part I. STROPHEODONTA.

By JOHN MITCHELL, late Principal of the Newcastle Technical College and School of Mines.

(Plates xxxix.-xlii.)

[Read 31st October, 1923.]

Introduction.

The history of the Stropheodonta group in Australia is a brief one, for the only forms belonging to it yet recorded from Australian rocks are the species described by Mr. Chapman (Proc. Roy. Soc. Vic., 16 (n.s.), 1903, 69-73, Pl. xi., figs. 5-7 and Pl. xii., figs. 1-6) from Lilydale, Vic. and considered by him to be of Upper Silurian age (Yeringian). They include the following species:—*Stropheodonta* (*Leptostrophia*) *alata* Chap., *S.* (*Brachyprion*) *lilydalensis* Chap. and *Strophonella euglyphoides* Hall.

In the present paper the following species of *Stropheodonta* are described, all except *S. tarloensis* being from the Bowning (*Bounyongian*) Beds which are practically the equivalents of Mr. Chapman's Melbourneian and Yeringian Beds, and of Barrande's étages E. and F. of the Upper Silurian of Bohemia:—*bendeninensis*, *silverdalensis*, *borseoides*, *conica*, *phalaenoides*, *transversa*, *lilydalensis* Chapman, *quadrata*, *incerta*, *davidi*, *minuta*, *tarloensis*, *bowningensis*, *striato-costata*, *striato-punctata*, *fragilis* and sp. indet. All are new except *lilydalensis*.

A remarkable thing about the Stropheodontas from the Bowning Beds is that those found in the Lower Trilobite beds and in beds below that horizon possess, almost without exception, spines proceeding from the cardinal angles and, in this particular, differ from foreign members of the group among which the possession of spines proceeding from the cardinal angles is very exceptional. These spines, together with the Leptostrophian character of their hinge plates and teeth, indicate their archaic origin. The forms derived from the upper beds are small, without cardinal processes and have the hinge-plate and teeth strongly developed; except for their small size, they appear to be more closely allied to Devonian than Silurian types. In size and in other respects the Bowning forms of the group differ from foreign types. *S. varistriata* Conrad and *S. perplana* Conrad, from the lower Helderberg, are the only ones among the many North American species which bear striking resemblances to any of the local types. *S. borseoides*,

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in size, shape, having a depressed umbonal area, and being strongly inflated ventrally, resembles *S. varistriata*. *S. euglyphoides* Chap. has some features in common with *S. perplana*. A close agreement in the two sets of types cannot be expected considering the great distance which separates them.

One of the most striking things observable in the local forms from the older beds is the absence of defined muscular areas on the brachial valves. Another feature found, almost if not altogether without exception, is the lateral extension of the hinge-plates into long, acicular, straight spines or processes. In a few cases spines of this nature are known to occur on foreign Stropheodonta and Strophonella, but with species from the older beds at Bowning, the occurrence is the rule and not the exception. This spination of the latero-cardinal angles seems to have belonged, in Australia, to the more ancient forms of the genus, just as appears to have been the case with some Stropheodontas of North America as, for example, *Brachyprion leda* Billings. Soon after passing above the Middle Trilobite Beds of the Bounyongian series, this type of Stropheodonta is no longer met with, but instead, a group of small forms makes its appearance. This group may be divided into two or more types—the smaller and more ancient type, which appears first in the Lower Trilobite Beds of the Bowning formation, is represented by *Stropheodonta minuta*; another by *Stropheodonta davidi* and perhaps still another by *Stropheodonta striato-punctata*.

Besides the species dealt with in the present paper, there are several others, the determination and description of which has been deferred for the present. They have chiefly been collected from the Lower Limestone Beds of Derrengullen Creek.

It may be stated that I have compared the Stropheodontas included in the present paper with those described and figured from the Devonian of the Northern Shan States by F. R. Cowper Reed (Pal. Indica, (N.S.), Vol. 2, mem. 5, 1908), and find none of those to be closely related to the Bowning forms. It appears, as is to be expected, that the fauna of the Shan States has closer affinity with the European fauna than with that of Australia.

In conclusion, I wish to thank Professor Sir Edgeworth David for his help in having the specimens photographed for the plates, Mr. W. S. Dun, Palaeontologist to the Geological Survey of N.S.W., for assistance in various ways and Dr. C. Anderson, Director, Australian Museum, for access to literature. Further my cordial thanks are tendered to Mr. H. G. Gooch for the photographs illustrating the paper.

STROPHODONTA BENDENINENSIS, n.sp. (Pl. xxxix., figs. 1, 2; Pl. xli., fig. 18).

Pedicle valve subsemicircular to subquadrate, strongly convex about the muscular area, somewhat depressed towards the lateral margin. The test is absent and has left no trace of the radials, but the vascular system is clearly exposed; the whole surface of the valve is densely covered with fine punctures. Hinge-plate fairly wide and evidently produced laterally into spines, but they are not shown on the specimen; muscular scars triangular, prominent and separated medially by a short and shallow septum; umbo moderately prominent and bifid. *Dimensions*: Length 12-13 mm., width 17-18 mm., depth (approx.) 3 mm.

The brachial valve is unknown.

One specimen has the test partly preserved, and shows the radials.

In outline this species resembles both *S. striata* Hall and *S. perplana* Conrad; but not in other respects.

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One specimen has the test partly preserved, and shows the radials.

In outline this species resembles both *S. striata* Hall and *S. perplana* Conrad; but not in other respects.

Loc. and horizon.—Yass-Buruwa road near Bendenine public school, Limestone Creek; and Bowning Creek, Parish of Bowning—Lower Trilobite beds of the Bounyongian Beds.

STROPHEODONTA SILVERDALENSIS, n.sp. (Pl. xxxix., fig. 3).

Pedicle valve (partly testiferous) large, subsemicircular, strongly convex. Radials numerous, not prominent, indistinct towards the cardinal angles. Concentric striae numerous but indistinct. Umbo prominent and depressed dorsally; muscular scars not exposed. Hinge-plate moderately wide, straight, produced into long spines at the cardinal angles. Punctures fine and numerous. Brachial valve not known. *Dimensions*: Length 20.3 mm., width 26.5 mm.

This is the largest of the Bowning Stropheodontas, but is only of medium size when compared with some from other countries. In size and in having the hinge-plate produced into spines at the cardinal angles it resembles *Stropheodonta perplana*, as it also does in possessing slightly wrinkled radials.

Loc. and horizon.—This species was collected from a thin bed of shale interbedded with the lower limestone beds near the junction of Derrengullen and Limestone Creeks, Parish of Derrengullen, County King. Upper Silurian.

STROPHEODONTA BORSEOIDES, n.sp. (Pl. xxxix., figs. 5-8; Pl. xl., fig. 9).

Brachial valve attains its greatest concavity medially and between there and the beak slopes gradually; it slopes more steeply towards the ventral margin; subsemicircular, ventral margin mildly rounded, sides almost vertical, radials faint, hardly visible on many (nontestiferous) specimens, simple, numerous, evenly spaced. Muscular scars and umbo invisible. Hinge-plate long, relatively wide, straight and produced into long slender spines at the cardinal angles; teeth small, few in number and borne on a low knife-edged ridge extending medially along the plate on each side of the beak. The valve has a very baggy or purse-like shape. Punctation invisible. The following is the description of what is assumed to be the pedicle valve: Strongly convex, except adjacent to the cardinal angles where it is depressed. Ribs numerous (about forty), thread-like, not so wide as the interspaces, faint near the cardinal angles. Punctures fine and of even size, not present near the margins. Muscular area triangular and prominent. Hinge-plate straight, produced into spines at the cardinal angles. A very delicate septum present. *Dimensions*: 12-16 mm. long, 18-22 mm. wide.

This is the largest Stropheodonta from the Lower Trilobite beds of the Bowning Beds, but it is much smaller than some from the limestone beds of Limestone Creek, and still smaller when compared with such species as *S. demissa* Conr. and *S. concava* Hall from U.S.A. It does not closely resemble any foreign species which has come under my notice nor is it identical with any of those described by Mr. Chapman from Victoria (Proc. Roy. Soc. Vict., 1903, 60-62, Pls. x.-xii.).

As the valves of the species have not been found conjoined it is not absolutely certain that the valves described above belong to the one species; but they were found in association and agree dimensionally, hence the assumption that they represent the two valves of a single species appears to me a reasonable one.

Loc. and horizon.—Lower Trilobite beds of the Bounyongian Beds, Bowning Creek, Silverdale and Hatton's Corner, Yass River, associated with *Enocrinurus bowningensis*, *E. mitchelli*, *Ceratocephala vogdesi*, *C. jacki*, *C. phalacrocephala*, *Odontopleura bowningensis*, etc.

Loc. and horizon.—Yass-Buruwa road near Bendenine public school, Limestone Creek; and Bowning Creek, Parish of Bowning—Lower Trilobite beds of the Bounyongian Beds.

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STROPHEODONTA CONICA, n.sp. (Pl. xl., fig. 10).

Pedicle valve obverse conical, evenly convex; radials thread-like, numerous, conspicuous on the median part only, and consisting of primaries and secondary interpolations; umbo fairly prominent; muscular area distinct; hinge-plate narrow, straight and produced into spines laterally; teeth small, numerous and apparently occurring along the whole length of the hinge-plate, except under the beak; punctation quite indistinct. Brachial valve unknown. *Dimensions*: Length 9.5, width 11.0, depth (approx.) 3 mm.

The distinctive features of the species are its reversed conical shape, the approximate equality of length and width and its long acicular lateral processes of the hinge-plate.

Loc. and horizon.—Minahan's selection, Bowning Creek, one and a half miles N.W. of Bowning township, Parish of Bowning. Lower Trilobite beds of the Bounyongian Beds.

STROPHEODONTA PHALAENOIDES, n.sp. (Pl. xl., fig. 11).

Pedicle valve convex, depressed near the cardinal angles where also the surface is smooth in nontestiferous specimens. Ribs not prominent, ridged, consisting of about twelve primaries and ten secondary interpolations, interspaces shallow. The whole surface very finely punctate, except near the margins; umbo prominent; muscular area triangular, divided by short and faint septum, and ill-defined. Hinge-plate narrow, straight, produced into long acicular spines at the cardinal angles; teeth few and very small. Brachial valve plain or very slightly convex; ribs indistinct, of irregular outline, in number apparently equal to those of the pedicle valve; concentric lines faintly visible. Hinge-plate, teeth and spines of the cardinal angles similar to those of the other valve; umbo and muscular area quite inconspicuous. *Dimensions*: Length 8.0, width 11.0, depth 1.5 mm.

The two valves of this shell have not been found in conjunction and therefore the placing of the two under one species may not be correct; but this will not affect the specific determination, as that is founded on the pedicle valve. The specimens used for the above description are nontestiferous, as are most of the specimens of shells recovered from the mudstones of the Bowning Beds, and it is from these mudstones our Stropheodontas are chiefly obtained, hence they, like the trilobites in general, must have been dwellers in muddy areas.

Loc. and horizon.—Minahan's selection, Bowning Creek, about one and a quarter miles N.W. of Bowning township, Parish of Bowning. Lower Trilobite beds of the Bowning (Bounyongian) Beds.

STROPHEODONTA TRANSVERSA, n.sp. (Pl. xl., fig. 13).

Pedicle valve (testless) mildly convex, transversely semielliptic, nearly twice as wide as long; hinge-plate narrow, slightly elevated medially; muscular scars indistinct; spines of the latero-cardinal angles of the hinge-plate long and acicular; teeth very small and numerous; little or no trace of radials and punctures is visible. *Dimensions*: Length 7.0, width 14.0 mm. approximately.

A testless specimen of what appears to be a brachial valve of this species is before me, but is fragmentary. It is almost flat, shows traces of a few ribs about $\frac{1}{2}$ mm. apart, separated by relatively wide and shallow spaces; muscular scars and cardinal process quite indistinct and in outline similar to the pedicle

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valve described above. The outstanding features of the species are its relatively great width, flatness, inconspicuous muscular scars and umbo.

Loc. and horizon.—Minahan's selection, Bowning Creek.

STROPHEODONTA SP. INDET. (Pl. xl., fig. 14).

This is represented by a pedicle valve from the Lower trilobite beds of the Bounyongian Beds at Derrengullen Creek. Its features are too vague for determination. It is strongly convex, umbo prominent; radials about forty, hinge-plate produced laterally into spines; teeth small and arranged along the whole length of the plate between the beak and lateral angles.

STROPHEODONTA (BRACHYPRION) LILYDALENSIS Chapman. (Pl. xl., fig. 15).

Pedicle valve subquadrate, moderately convex, depressed adjacent to the cardinal angles; radials very numerous, concentric lines indistinct; punctures fine, very numerous and arranged along the interspaces. Muscular area prominent, triangular and large; umbonal slopes prominent and for a short distance from the cardinal area bounded by a row or two of relatively large punctures; a shallow and narrow septum extends from the cardinal margin medially almost to the ventral boundary of the muscular scars; cardinal area narrow; teeth faint and apparently of the *Leptostrophian* type. Lateral margins nearly vertical, anterior rounded and, if a point be taken medially 6 mm. from the cardinal margin, the portion anterior to this forms a semicircle. *Dimensions*: Length 18.0, width 24.0 mm., approximately.

The specimen used for the above description is testless. Although there are no spines on the valve now before me extending from the cardinal angles, I am inclined to the opinion that originally such were present.

The resemblances in this to *Stropheodonta (Brachyprion) lilydalensis* Chapman, are so striking that I place it with that species; they agree in the external features of ribbing, punctation and outline, but in some other respects they differ. Dimensionally Chapman's species is larger than ours and the ratio of length to width is a little different in the two; our specimen is a pedicle valve (cast) and shows rather indifferently the internal features only.

Mr. Chapman places his specimen in the subgenus *Brachyprion*. I am inclined to place the New South Wales form with *Leptostrophia*. It may be pointed out also that our fossil occurs in strata older than the limestones of Limestone Creek and much older than the Yeringian, but probably equal in age to some of the lower Melbournian Beds.

Loc. and horizon.—Railway cutting about three-quarters of a mile west of Bowning railway station, from rocks near the base of the Bowning Beds. Upper Silurian.

STROPHEODONTA (LEPTOSTROPHIA) QUADRATA, n.sp. (Pl. xl., fig. 16).

Pedicle valve quadrate, mildly and evenly convex. Radials fairly numerous and dichotomising near the margins at least; muscular area and umbo moderately prominent; along the bases of the umbonal slopes are some punctures of larger size than occur elsewhere on the cast. Punctures most numerous and distinct on a zone enclosing the muscular area; outside of this zone they are finer and indistinct. Cardinal area narrow, straight and produced laterally into spines. Hinge-plate narrow and its teeth indistinct. Anterior adductors narrow, diductors large. *Dimensions*: Length 12.0, width 13.0 mm.

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This species resembles the preceding one in some respects; but differs from it in being squarer, less densely punctate and radiate.

Loc. and horizon.—The same as for the preceding species.

STROPHEODONTA INCERTA, n.sp. (Pl. xli., fig. 17).

Brachial valve (testless) concave, depressed near the cardinal angles and laterally; muscular scars flabellate and indistinct; a very conspicuous septum extends from the cardinal area medially for three parts of the length of the valve. Cardinal area narrow. teeth strong and divergent. Only traces of punctures visible; none of the ribs remain. *Dimensions*: Length 12.5, width 18.75 mm.

The chief reason for giving this specimen specific rank is the presence of the unusual septum which is distinctly different from that observed in other local species. Associated with *S. quadrata* at the same locality.

STROPHEODONTA DAVIDI, n.sp. (Pl. xli., figs. 19-21).

Shell concavo-convex, small, subsemicircular.

Brachial valve mildly and evenly concave. radials consisting of thread-like primaries, between each pair of which occurs a secondary and on each side of a secondary is a tertiary interpolation; there seem to be about eight primary ribs on each side of the medial one. Muscular scars circular; the diductors are separated from the adductors by relatively deep septa and outward of these and parallel to them they are further dissected by two to three less distinct ones; adductors narrow and acutely triangular. Muscular area bordered laterally by three or four irregular rows of very distinct punctures; between these and the margins the punctures are very fine; cardinal process simple and prominent. Cardinal area narrow. Hinge-plate as wide as the shell, bearing about twelve to fourteen fine teeth on each side of the beak. Pedicle valve strongly convex, muscular scars prominent, apically divided by a short septum; radiation similar to that of the brachial valve but more distinct; punctuation very fine. *Dimensions*: Length 4-4.8; width 6-6.3 mm.

This species though small is an interesting one; it seems to be a specialised representative of a group of small Stropheodontas, which occur in the Bounyongian Beds, and in rocks traversed by the upper reaches of the Tarlo River near Crookwell, N.S.W. It occurs associated with numerous Nuculoid species of pelecypods, *Odontopleura jenkinsi*, *O. rattei*, *Ceratocephala (Dicanurus) longispinosa*, *Dalmanites loomesi*.

Loc. and horizon.—Bowning township, Parish of Bowning. Upper Trilobite beds, Bounyongian Beds. Probably Lower Devonian, but had, by the late Mr. Etheridge and myself, been formerly considered as the uppermost beds of the Upper Silurian system in New South Wales.

Dedicated to Professor Sir Edgeworth David as a small token of appreciation of the great work done by him in elucidating many important problems connected with Australian geology.

STROPHEODONTA MINUTA, n.sp. (Pl. xli., figs. 22-25).

Whole shell concavo-convex, semicircular; test thin, laminate and chalky.

Pedicle valve strongly convex. Twelve primary radials distinctly visible and a few near the cardinal angles much less so; the medial pair become three- to

This species resembles the preceding one in some respects; but differs from it in being squarer, less densely punctate and radiate.

Loc. and horizon.—The same as for the preceding species.

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Brachial valve (testless) concave, depressed near the cardinal angles and laterally; muscular scars flabellate and indistinct; a very conspicuous septum extends from the cardinal area medially for three parts of the length of the valve. Cardinal area narrow. teeth strong and divergent. Only traces of punctures visible; none of the ribs remain. *Dimensions*: Length 12.5, width 18.75 mm.

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Brachial valve mildly and evenly concave. radials consisting of thread-like primaries, between each pair of which occurs a secondary and on each side of a secondary is a tertiary interpolation; there seem to be about eight primary ribs on each side of the medial one. Muscular scars circular; the diductors are separated from the adductors by relatively deep septa and outward of these and parallel to them they are further dissected by two to three less distinct ones; adductors narrow and acutely triangular. Muscular area bordered laterally by three or four irregular rows of very distinct punctures; between these and the margins the punctures are very fine; cardinal process simple and prominent. Cardinal area narrow. Hinge-plate as wide as the shell, bearing about twelve to fourteen fine teeth on each side of the beak. Pedicle valve strongly convex, muscular scars prominent, apically divided by a short septum; radiation similar to that of the brachial valve but more distinct; punctuation very fine. *Dimensions*: Length 4-4.8; width 6-6.3 mm.

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STROPHEODONTA MINUTA, n.sp. (Pl. xli., figs. 22-25).

Whole shell concavo-convex, semicircular; test thin, laminate and chalky.

Pedicle valve strongly convex. Twelve primary radials distinctly visible and a few near the cardinal angles much less so; the medial pair become three- to

four-forked, and the others two to three as the margins are approached. The punctures are relatively large, of even size and radially arranged along the spaces between the ribs; umbo prominent. Muscular scars indistinct; cardinal area and hinge-plate narrow and equal in length to the greatest width of the shell. Brachial valve concave, and in ribbing and punctation agrees with the pedicle valve. Cardinal area and hinge-plate fairly wide; cardinal process small and simple. Teeth indistinct. *Dimensions*: Length 2-2.5, width 4-5, depth 1 mm.

This species is remarkable for its small size, relative largeness of the punctures adorning the inner surface of the valves, and also for its strong dichotomous ribbing.

Horizon.—Bowling and Yass Beds from the Lower Trilobite beds upwards; but is most common in the lower beds.

STROPHEODONTA TARLOENSIS, n.sp. (Pl. xli., fig. 26).

Whole shell transverse-oblong or sub-semielliptic, concavo-convex, both valves finely and evenly, but not densely punctate; radials of each valve consist of some ten primaries; between each pair of the medial ones four others are interpolated as the margin is approached, and between each pair of lateral primaries two secondaries occur. The pedicle valve is mildly convex, umbo and muscular scars moderately prominent, depressed near the cardinal angles. Hinge-plate linear. Teeth submicroscopic. Brachial valve mildly concave. Cardinal area indistinct, with dental sockets distinct and widely divergent; its ribbing similar to that of the other valve. *Dimensions*: Length 2.0, width 5.0 mm.

In several respects this species resembles the preceding, *S. minuta*, but is shorter, wider, shallower and the punctures of the shell are finer, as also are the ribs; it is easily separable by these differences.

Loc. and horizon.—Junction of Baek Creek and Tarlo River, Parish of Turrallo, County Argyle, one mile N.W. of the slate quarry; associated with *Odontopleura hartlei* and with an undetermined *Encrinurus*. Either Upper Silurian or Lower Devonian, for the present doubtful.

STROPHEODONTA BOWNINGENSIS, n.sp. (Pl. xlii., fig. 27).

Brachial valve mildly concave, subsemicircular or subquadrate; radials preserved on the median part only, seven or eight relatively strong ones visible; umbonal ridges fairly pronounced, and along their outer edges are rows of five or more, relatively large punctures, and others less regularly placed, the rest of its surface bearing finer punctures; diductor scars strong and ridged, adductor scars narrow and faint; hinge-plate straight, bearing thirty-two or more pectinate teeth. The cardinal area is narrow, and the cardinal process simple and prominent. *Dimensions*: Length 5.0, width 7.0 (approx.) mm. Pedicle valve unknown.

I am doubtful whether this should not have been placed with *Strophonella*, but the teeth are of the Stropheodonta type.

Loc. and horizon.—Railway cutting about three-quarters of a mile west of the Bowling railway station, from rocks older than the limestones of Limestone Creek, associated with *Atrypa reticularis*, *Encrinurus mitchelli*, *Stropheodonta quadrata*, and a *Spirifer* near *Sp. bicostatus* Hall from the Niagara formation of North America.

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This species is remarkable for its small size, relative largeness of the punctures adorning the inner surface of the valves, and also for its strong dichotomous ribbing.

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Whole shell transverse-oblong or sub-semielliptic, concavo-convex, both valves finely and evenly, but not densely punctate; radials of each valve consist of some ten primaries; between each pair of the medial ones four others are interpolated as the margin is approached, and between each pair of lateral primaries two secondaries occur. The pedicle valve is mildly convex, umbo and muscular scars moderately prominent, depressed near the cardinal angles. Hinge-plate linear. Teeth submicroscopic. Brachial valve mildly concave. Cardinal area indistinct, with dental sockets distinct and widely divergent; its ribbing similar to that of the other valve. *Dimensions*: Length 2.0, width 5.0 mm.

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STROPHEODONTA STRIATO-COSTATA, n.sp. (Pl. xlii., figs. 29, 30).

Whole shell nearly semicircular and concavo-convex.

Pedicle valve mildly convex, radials consisting of eleven primaries which dichotomise once at an early stage of their growth, and each division bears on its surface several very fine radial striae. In addition to these primaries and their forks, adjacent to the cardinal angles, are some five very fine simple radials. All the primaries and their divisions are superficially depressed, and separated from each other by shallow, narrow, but conspicuous spaces. Concentric striae fine and only visible near the margins. Surface very finely and densely punctate. Muscular scars indistinct and medially divided by a short, narrow, deep slit or septal scar. Umbo not prominent. Cardinal area and hinge-plate narrow and as long as the shell is wide. Teeth very fine and appear to be borne on the greater part of the space between the umbo and the cardinal angles. Brachial valve mildly concave, radials similar to those of the pedicle valve; punctation indistinct. Hinge-plate fairly wide and of low triangular shape, resembling that of some *Plectambonites*. Teeth in part arranged on low knife-edged ridges extending from each side of the cardinal process about half-way to the cardinal angles. Cardinal process indistinct. *Dimensions*: Length 3-4.5, width 6-8 mm.

This is another small *Stropheodonta*, and seems to be confined to the uppermost beds of the Bounyongian Beds.

STROPHEODONTA STRIATO-PUNCTATA, n.sp. (Pl. xlii., fig. 31).

Pedicle valve very mildly convex; radials consist of very numerous and fine striae, punctures fine and numerous; umbo inconspicuous and divided by a short slit-like septum; hinge-plate narrow and as wide as the valve. *Dimensions*: Length 6.0, width 8.0 mm. Brachial valve unknown.

The unusually numerous and fine radial striae and punctures separate this species from all others which have come under my notice.

Loc. and horizon.—The same as for *Stropheodonta davidi*.

STROPHEODONTA FRAGILIS, n.sp. (Pl. xlii., figs. 32, 33).

Pedicle valve truncato-discoidal and very mildly convex; radials consist of about eighteen primaries with some interpolations near the ventral margin, thread-like; interspaces wide and shallow; umbo inconspicuous and under the test is mildly bifid; muscular area depressed, hinge-plate narrow and produced laterally; punctures fine and arranged in two to three irregular rows within the interspaces; hinge-plate narrow, laterally produced into long spines; teeth small, nine or ten visible on the right-hand side, where the test is absent. *Dimensions*: Length 10.0, width 11.0 mm.

Loc. and horizon.—Minahan's selection, Bowning Creek, one and a half miles N.W. of Bowning township.

This *Stropheodonta* agrees dimensionally with *Brachyprion leda* Bill., but its processes extending from the cardinal angles are very much longer and finer and its teeth are more numerous, spread over a greater area of the hinge-plate, and smaller; the hinge-plate is narrower. It certainly does not belong to the *Brachyprion* group.

STROPHEODONTA STRIATO-COSTATA, n.sp. (Pl. xlii., figs. 29, 30).

Whole shell nearly semicircular and concavo-convex.

Pedicle valve mildly convex, radials consisting of eleven primaries which dichotomise once at an early stage of their growth, and each division bears on its surface several very fine radial striae. In addition to these primaries and their forks, adjacent to the cardinal angles, are some five very fine simple radials. All the primaries and their divisions are superficially depressed, and separated from each other by shallow, narrow, but conspicuous spaces. Concentric striae fine and only visible near the margins. Surface very finely and densely punctate. Muscular scars indistinct and medially divided by a short, narrow, deep slit or septal scar. Umbo not prominent. Cardinal area and hinge-plate narrow and as long as the shell is wide. Teeth very fine and appear to be borne on the greater part of the space between the umbo and the cardinal angles. Brachial valve mildly concave, radials similar to those of the pedicle valve; punctation indistinct. Hinge-plate fairly wide and of low triangular shape, resembling that of some *Plectambonites*. Teeth in part arranged on low knife-edged ridges extending from each side of the cardinal process about half-way to the cardinal angles. Cardinal process indistinct. *Dimensions*: Length 3-4.5, width 6-8 mm.

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EXPLANATION OF PLATES XXXIX.-XLII.

Plate xxxix.

(Figures enlarged $2\frac{1}{2}$ or more times.)Fig. 1-2.—*Stropheodonta bendeninensis* Mitchell.

1. A testless pedicle valve showing the muscular area, umbo and vascular system. 2. Another pedicle valve of the same species, showing the muscular scars, puncturation, vascular system in part and a portion of one of the spines, extending from the left cardinal angle.

Fig. 3.—*Stropheodonta silverdalensis* Mitchell.

A front view of a pedicle valve showing strong convexity, fine radiation and punctures.

Figs. 4-8.—*Stropheodonta borsioides* Mitchell.

4. A pedicle valve showing the fine radials, punctures, etc.

5. A brachial valve of the preceding, showing the hinge-plate and fine teeth faintly, and some of the radials.

6-8. Pedicle valves of the same.

Fig. 7 represents a perfect valve which shows a complete hinge-plate and small teeth.

Plate xl. (Figures much enlarged.)

Fig. 9.—*Stropheodonta borsioides* Mitchell.

Shows the radials and acicular processes of the cardinal angles of a pedicle valve.

Fig. 10.—*Stropheodonta conica* Mitchell.

A pedicle valve showing the ribbing, processes of the hinge-plate and outline.

Fig. 11.—*Stropheodonta phalaenoides* Mitchell.

A perfect testless valve, in which the main features are visible.

Fig. 12.—*Stropheodonta bendeninensis* Mitchell.

A good photo of a testless pedicle valve (x. 4). The shell above it is *S. minuta*.

Fig. 13.—*Stropheodonta transversa* Mitchell.

A testless brachial valve.

Fig. 14.—*Stropheodonta*, sp. indet.Fig. 15.—*Stropheodonta (Brachyprion) lilydalensis* Chapman.

Pedicle valve (testless); shows clearly the numerous fine radials, the densely punctate surface, muscular scars and median septum.

Fig. 16.—*Stropheodonta quadrata* Mitchell.

Shows the muscular scars, absence of median septum, the large punctures along the base of each umbonal ridge and the finer punctures on the rest of the surface.

Plate xli. (Figures enlarged; some 9 times.)

Fig. 17.—*Stropheodonta incerta* Mitchell.

A pedicle valve (?), showing the pronounced median septum, punctures and outline.

Fig. 18.—*Stropheodonta bendeninensis* Mitchell.

A pedicle valve with test partly preserved and showing it to consist of three layers; the middle bears the punctures and the under layer carries short spines which fit into the punctures of the layer above, and which are plainly shown; the ribs are also visible.

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A pedicle valve with test partly preserved and showing it to consist of three layers; the middle bears the punctures and the under layer carries short spines which fit into the punctures of the layer above, and which are plainly shown; the ribs are also visible.

Figs. 19-21.—*Stropheodonta davidi* Mitchell.

19. A brachial valve, internal view, showing the important structural features.

20. A pedicle valve of the same, showing the large muscular scars.

21. Another specimen, showing the valves open and conjoined by the hinge.

Figs. 22-25.—*Stropheodonta minuta* Mitchell.

22. A view of the open valves joined along the hinge; the valves are testless and show the features clearly.

23-25. Specimens of the same species and show pedicle and brachial valves; 23 is partly testiferous.

Fig. 26.—*Stropheodonta tarloensis* Mitchell.

Pedicle and brachial valves joined along the hinge. The primary and finer intermediate radials, the punctures and strong muscular scars of the pedicle valve are clearly though faintly visible.

Plate xlii. (Some of the figures are enlarged 6 times or more.)

Fig. 27.—*Stropheodonta bowningensis* Mitchell.

An interior view of a brachial valve, showing the important features rather well.

Fig. 28.—*Stropheodonta phalaenoides* Mitchell.

A brachial valve showing the radials, concentric striae, hinge processes, etc.

Figs. 29-30.—*Stropheodonta striato-costata* Mitchell.

29. A brachial valve showing the radials, striae, punctures, hinge-plate and teeth.

30. The two valves of the same species, open and joined by their hinges; they show the radials fairly well and the radial striae and punctures faintly.

Fig. 31.—*Stropheodonta striato-punctata* Mitchell.

A pedicle valve showing the crowded punctures and short median septum, and the radial striae faintly.

Figs. 32-33.—*Stropheodonta fragilis* Mitchell.

32. A pedicle valve showing the radials, fine punctures, slightly bifid beak (cast of) and teeth on the hinge-plate.

33. Another pedicle valve of the above to show the processes of the cardinal angles.

Figs. 19-21.—*Stropheodonta davidi* Mitchell.

19. A brachial valve, internal view, showing the important structural features.

20. A pedicle valve of the same, showing the large muscular scars.

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